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ABSTRACT

The present study was designed to determine if subjects of different ages are equally distracted by meaningless perceptual and by semantic features of potentially interfering information. In contrast to a Stroop-like task, figures instead of words were used as possibly interfering information. First graders, fourth graders, and college students labeled the color of background circles in four different conditions. In the baseline condition circles which were simply color patches were presented. In three interference conditions meaningless, meaningful, and colorful meaningful figures were embedded in the circles. The difference in naming latencies between the four conditions permitted the identification of the components of interference produced by the figures. Differences in naming latencies across grade levels within each experimental condition were investigated to determine developmental trends in speed of response. The response times of the first graders, but not of the fourth graders and college students, were increased by the presence of the embedded figures. The interference at the first grade level was based on the semantic aspect of the embedded figures. In all conditions speed of response increased as a function of age. (Author/MP)

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Which Components of Task-Irrelevant Information Are Distracting?: A Developmental Study

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ABSTRACT

Developmental changes in the ability to direct selective processing were investigated using a Stroop-type task. First graders, fourth graders, and college students labeled the color of background circles in four different conditions. In the baseline condition only plain circles were presented. In three interference conditions meaningless, meaningful, and colorful meaningful figures were embedded in the circles. The difference in naming latencies between the four conditions permitted the identification of the components of interference produced by the figures. Differences in naming latencies across grade levels within each experimental condition were investigated to determine developmental trends in speed. The response times of the first graders, but not of the fourth graders and college students, were increased by the presence of the embedded figures. The interference at the first grade level was based on the semantic aspect of the embedded figures. In all conditions speed increased as a function of age.

In a seminal study in 1935, Stroop asked adults to name the color of color patches and of color words where the ink color was incongruously combined with the color word. He demonstrated that it takes longer to name the color of the color word than to name the color of the control patch. For example, it takes longer to name the blue ink color of the printed word red than to name a blue patch of color. Further research has indicated that other words and even meaningless symbols may delay the color naming response in comparison to a control condition where simple patches of color are used.

Many investigators have attempted to pinpoint the source of the delay or interference in color naming. Ray (1974) attempted to identify the source of interference by comparing naming latencies in four conditions. In a control condition adults were asked to label the color of rectangular patches. In the first interference condition, they labeled the color of meaningless symbols; it was assumed that any interference would be produced at the perceptual level. In the second interference condition, the adults labeled the ink color of words unrelated to color; it was assumed that in this condition interference would be produced both at the perceptual level and by the reading response evoked by the word. Finally in the third interference condition, the adults named the ink color of incongruous color words. Ray (1974) hypothesized that in this condition interference would be caused by perceptual distraction and word reading in addition to the response competition created by the semantic similarity between the color word and the color name.

Ray (1974) found that naming latency increased with the addition of each potential source of interference. Thus, she claimed that the interference to color naming produced by color words is caused by all three sources of potential distraction: perceptual distraction, word reading, and response competition

caused by the semantic similarity between the ink color and the color word.

The present study was designed to determine if subjects of different ages are equally distracted by meaningless perceptual and by semantic features of potentially interfering information.

In contrast to the Stroop-like task cited above, we used figures instead of words as possibly interfering information. In color-word tasks older subjects are more familiar with the word and this greater familiarity may influence the amount of interference created by the word. For example, Schiller (1966) noted that first graders were less distracted by color words than second and third graders because first graders were not as proficient in reading.

In the present study, 7-, 10-, and 24-year-olds were asked to name as rapidly as possible the color of each circle in a 6x6 matrix of colored circles. There were four conditions. In the baseline condition, the circles were simply color patches. In the other three conditions a potentially distracting form was centered in each circle. In the second, third, and fourth conditions respectively, meaningless outlined figures (Vanderplas & Garvin, 1959), meaningful outlined figures easily recognized by children (e.g., hat, flower), and meaningful color figures (of colors different from the background circles) were used.

It was hypothesized that the distraction produced by the meaningless figures would be perceptual in origin, that produced by the meaningful figures would be based on both perceptual contour and the meaning of the figure, and that produced by the colored meaningful figures would be based on the contribution of the perceptual contour, the meaning, and the color of the figure.

Each subject participated in each of the four conditions. To eliminate possibly confounding practice effects, four sequences of colors were used to

construct matrices for each of the four conditions and order of condition and of color sequence were counterbalanced across subjects within each age.

Absolute response times (i.e., time to label all 36 colors in a matrix) and log transformations of absolute response times were subjected to 3(Age) X 2(Sex) X 4(Condition) repeated measures analyses of variance, using the multivariate approach to repeated measures. The analyses of both absolute response times and of log transformations of absolute response times revealed the same pattern of results. The effect of age was significant, F (2,54) = 42.29, $p < .001$, showing that speed increased with age. Mean naming latencies for first graders, fourth graders, and adults were 38.37, 28.71, and 18.74 respectively. The main effect of condition was significant, F (3,52) = 12.04, $p < .001$ indicating that naming latency increased as a function of interference from Condition 1 to Condition 4. The means for conditions 1, 2, 3, and 4 were 21.14, 27.20, 29.80, and 30.23 respectively. The age by condition interaction was significant, F (6,104) = 3.80, $p < .002$. The main analysis revealed neither the main effect of sex nor the interactions between the sex and the other factors were significant, so the data were pooled in the following analysis.

The mean naming latencies and standard deviations for each condition as a function of grade level are presented in Table 1. Tests of simple main effects used to probe the interaction between age and condition showed (1) that within each condition speed increased with age and (2) that the effect of condition was not significant for 10-year-olds and adults but was significant for 7-year-olds. The response times of 7-year-olds were significantly longer when they named color patches with embedded meaningful and colored meaningful figures than when they named color patches or color patches with meaningless figures.

An 3(Age) X 2(Sex) X 4(Condition) analysis was also performed on the

errors made while naming the colors. This analysis revealed only a significant effect of age; the number of errors decreased with age but was comparable across conditions.

In sum, these data suggest that there was an increase in selectivity with age, for only the 7-year-olds were distracted by any type of embedded figures. Furthermore, the 7-year-olds were distracted primarily by the meaningful figures. The finding that the semantic aspect of task-irrelevant information was more distracting than mere perceptual interference is consistent with studies conducted to determine the nature of picture-word interference (e.g., Ehri, 1976; Rosinski, Golinkoff & Kukish, 1975). For example. Rosinski presented second-grade, fourth-grade, sixth-grade, and college level subjects with superimposed words and pictures. He found that picture labeling was delayed by the presence of incongruent words at all age levels. The lack of interference at the older age levels in the present study is inconsistent with the picture-word interference studies in which meaningless syllables and meaningful words had distracting effects at all age levels. The discrepancy between these two sets of results seems to be based on the fact that reading is one of those activities which does not require conscious allocation of attention (LaBerge & Samuels, 1974), for when individuals are presented with words the coding system is automatically invoked. Consequently, when subjects are presented with color words, they automatically read the word and the reading response then interferes with the naming response (Posner & Snyder, 1975).

In conclusion, the present study has indicated that younger children are distracted by meaningful aspects of irrelevant information. Older children and adults can selectively focus on the relevant dimensions of the stimulus situation if distracting information is not automatically processed. Finally, it has shown that speed increases with age.

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Table 1. - The Means and Standard Deviations for Each Condition as a Function of Grade Level

		Condition			
Grade Level		Baseline	Meaningless	Meaningful	Meaningful-Colorful
First Grade	M	36.07	34.90	40.92	41.60
	SD	10.30	9.18	11.25	10.71
Fourth Grade	M	27.32	28.49	29.48	29.54
	SD	5.71	6.89	6.98	5.35
Adults	M	18.03	18.22	19.175	19.56
	SD	3.99	3.29	3.70	3.98